

containing 1 to 3 low, radial teeth, forming transverse barriers on the basal wall, and appearing when the shell is viewed from the base as white radial stripes. Jackson county, Alabama, on hills (H. E. Sargent); Washington, D. C. (E. Lehnert). The radiating "teeth" are of exactly the same type found in *Gastrodonta lamellidens* Pils.—a species of very different form.

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SOME STUDIES ON THE MORPHOLOGY OF THE CYCLADIDÆ.

BY DR. V. STERKI.

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1. It has been said that there are two *cardinal teeth* in the right valves of *Pisidium amnicum* Müll. and *P. virginicum* Gmel., while all the other *Pisidia* have only one, and a group has been founded mainly on that character. Examination of numerous specimens of both species have shown me that that feature is only apparent. In young and half-grown shells the cardinal teeth of the right valves are single, just as in other species, only more curved, and as they grow older there is a slight indentation in the middle. There the growth of the tooth ceases, while both ends keep on growing, until at last there are apparently two teeth, which, however, can usually be seen more or less distinctly coherent, even in mature mussels. The same character has often been noticed in specimens of *P. variable* and *compressum*, where the "two teeth" were sometimes completely separated.

2. *Reversed hinges.* A few years ago Mr. Bryant Walker published some interesting notes\* about abnormal hinges in *Sphaeria*. I had made some observations on the same subject, and have continued doing so since. Three different arrangements were found:

1. The posterior laterals are reversed.
2. The anterior laterals and the cardinals.
3. The whole hinge is reversed, laterals and cardinals.

As Mr. Walker says, the posterior laterals and the cardinals alone were never seen reversed, nor both pairs of laterals alone, nor did I see the anterior laterals alone, nor the cardinals alone reversed. Evidently the anterior laterals plus the cardinals form a kind of a unity, being situated in front of the ligament, and when one part of them are reversed all are so, while the posterior laterals stand alone. And the reversion does not only affect the numbers of the teeth, but their whole

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\*THE NAUTILUS, IX., p. 135. (April, 1896.)

character. In the normal hinge the (single) lateral teeth of the left valve are higher than those of the right one, usually projecting above the level of the valve-edge. The reversed teeth are so in the right valve. Reversion in one or other degree was seen in hundreds of specimens of the *Sphaeria* s. str.: *simile*, *striatum*, *stamineum*, (v.) *emarginatum* and other forms, *flavum*, *fabale*, *nobile*, *primeanum*, and in lots from some localities in 20 to 30 per cent. of all specimens. Might it be inferred, from the great instability of the hinge characters, as well as the almost endless variability in shape, size and striation of some species, that the whole group is of a recent geological age, with the features not fully established? Has any such variability been noticed in *Corbicula*, etc., or in the marine *Cardiacea*?

In *Sphaeria rhomboideum*, *occidentale*, *corneum*, etc., reversion seems to be rare; and so in *Calyculina*. It has been noticed in *Pisidium virginicum* (three specimens, cardinal and anterior laterals), *abditum* (totally and partly), and *politum* (one specimen, totally reversed). These were the only instances noticed among many hundred, probably thousands, of *Pisidia* examined for the hinge characters.

3. *Ridges on the beaks of some Pisidia.* Ridges (or appendages) are known to be present on the beaks of a number of species, such as *supinum*, *henslowianum*, *compressum*, *fallax*, *cruciatum*, *punctatum*, *ferrugineum*, and for some of them they have been described as characteristic. Of the North American species they have been seen wanting in *P. compressum*, *fallax* and *punctatum*, usually in forms which are characterized also by other peculiar features, and must be regarded as varieties. But sometimes all possible intergradations may be seen among specimens from one locality and ranging under the same "form" or variety. In *P. cruciatum* the singularly shaped ridges have been found absolutely constant so far.

On the other hand, beaks with their tops more or less flattened, and with slight indications of ridges, may be seen in species where they are usually rounded, as in *P. variabile*, *abditum*, *splendidulum*. Among lots of the latter species, from Aroostook county, Maine, specimens were found with very strong ridges, just as in *P. ferrugineum*, and they would have to be regarded as representing a widely distinct species, if it were not for intermediate forms.

This is one well marked example of the often perplexing variability of those small mussels, and strongly urges the student not to rely on one or other ever-so-striking feature for the distinction of species, but to carefully consider the *ensemble* of all the different characters, all of

which may be variable to a lesser or higher degree. It shows also that it is impossible to found a species upon one or even a number of specimens from one locality with any degree of certainty.

4. *Beaks of Calyculina.* The presence of "calyculate" beaks and of caps on them, has been regarded as characteristic, first, for the type species (*C. lacustris* Müll.), and then for the genus. Both these characters had to be given up, as being not shown by all species (e. g. *transversa*) of the otherwise well-defined genus. As to the "caps," they are by no means a constant feature of such species as *C. partumeia*, *securis*, etc., and during the last years numerous specimens were seen with the beaks simply rounded and having not even traces of caps. These caps are nothing else but the embryonic shell of the mussel, which is oblong or elliptic in perpendicular section, and the additional growth is formed at an angle as a rule. It seems that the specimens without caps were hatched during the warmer season, when the young may be expelled at an earlier stage of growth, while in cold weather they are retained longer in the brood pouches of the parent and there grow more convex. Numerous young have been seen with several narrow stripes, separated by lines of growth, along the edges of the valves. On the other hand, specimens of *C. transversa* are now and then seen with caps, and occasionally also *Sphaeria* and different species of *Pisidia*. This point deserves to be studied more exactly.

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#### GENERAL NOTES.

STATION OF *LIMNÆA GRACILIS*.—We have received from Mr. Bryant Walker the following note on the above species, extracted from a letter from Dr. R. J. Kirkland :

"Perhaps you will be interested in an observation respecting *Limnæa gracilis* Say. I think Dr. DeCamp was the only person who found it in Reed Lake, near this city (Detroit, Mich.), and he only found it one year in May. He once told me he collected eighty-five on the rushes, where 'they had come to spawn.' I have searched for it in the spring for the past three years, but have never found one. Last fall, as I wrote you, I found quite a number in November. This fall, I found five on September 17, in the same place as last fall. A week later found eighteen, two weeks later found fifty. After that only two or three on each of several visits. I think it was because the community was exhausted. Have searched at other points in the lake, but unsuccessfully. They were found